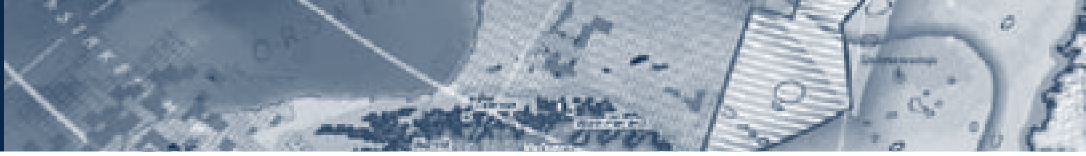
DEN NORSKE ATLANTERHAVS KOMITE
THE NORWEGIAN ATLANTIC COMMITTEE



FOCUS NORTH **1-2007**

Nuclear Challenges

Produced by the research company Ocean Futures, Oslo for the Norwegian Atlantic Committee

Sources of contamination

The main source of radioactive contamination in the Arctic comes from fallout released by atmospheric tests of nuclear weapons. The next largest are routine discharges to the sea from nuclear fuel reprocessing plants in the UK and France, and fallout from the 1986 Chernobyl accident.

Other sources have caused localized contamination in the Arctic. These include several accidents, waste dumped by the Russian navy, routine discharges from nuclear power plants, and inadequate storage and handling of reactor fuel and radioactive wastes at civilian and military facilities (see Fact Box 1).

Of greatest concern today is the potential for major accidents. An accident with a nuclear weapon or at the Kola nuclear power plant poses the greatest threat of severe, long-range, long-lasting consequences.

Nuclear-powered ships also represent a risk of potential contamination. Russia built 254 nuclear-powered submarines and warships, two-thirds of which operated from the Kola Peninsula. Today, only a quarter of these are in service. The remainder have been retired and are in various stages of being scrapped—a process that involves a significant amount of fissile material and radioactive waste that must in turn be disposed of ashore (see Fact Box 2).

Although the dismantling process is intended to improve what is currently a hazardous situation, it can also result in accidents and localized contamination. The sinking of submarine *K-159* in 2003 while it was being towed to a shipyard for defueling and scrapping is a case in point.

What threat does it represent?

Harm to humans and the biosphere

Radiation can damage cells in plants and animals. Long-term exposure increases the risk of cancer and genetic damage. Acute exposure to high doses—usually the result of being near a serious accident—can kill cells, which can cause radiation sickness and possibly death.

Fact Box 1 – Nuclear facilities and pollution sources in northwest Russia

Nuclear weapons – An undisclosed number of weapons are located aboard ships and at bases in northwest Russia.

Kola nuclear power plant – At Poliarny Zori, south of Murmansk. It has four 440 megawatt pressurized water reactors. They lack a safety containment to prevent the spread of radioactivity in the event of an accident.

Russian Northern Fleet – The navy has 36 nuclear-powered submarines and warships operating from four naval bases on the Kola Peninsula.

Retired submarines – In autumn 2005, there were 56 retired submarines awaiting dismantling; 33 with fuel in their reactors.

Nuclear-powered icebreakers – The Murmansk Shipping Company operates six nuclear-powered icebreakers and one nuclear-powered cargo ship.

Nuclear fuel – fresh reactor fuel for nuclear-powered vessels is stored at the Severomorsk naval facility near Murmansk and aboard 3 service ships.

Nuclear waste – Four naval bases, two storage facilities, and five shipyards in the Murmansk and Arkhangelsk regions handle spent nuclear fuel and radioactive wastes. At Andreeva Bay, 22,000 fuel elements are stored in poor conditions 50 km from the Norwegian border.

Dumped waste – From 1959 to 1991, the Soviet navy disposed of radioactive waste in the Arctic seas. Six submarine reactors with fuel were disposed of in the Kara Sea and the fjords of Novaya Zemlya. Low-level liquid waste was disposed of in the Barents and Kara Seas.

Accidents –

- 1989: Submarine *Komsomolets* sank SW of Bjørnøya. The wreck lies at a depth of 1700 meters and contains one reactor and two nuclear warheads.
- 2000: Submarine *Kursk* sank north of Murmansk. Wreck raised and scrapped.
- 2003: Submarine *K-159* sank near Murmansk while being towed to a shipyard for scrapping. The wreck contains two reactors with fuel.

Much attention has focused on the potential for contamination from retired submarines. An accident while removing the reactor fuel would cause the greatest contamination (about 1 percent of the radiation released by the Chernobyl accident). The risk of *cross-border* contamination from a fuelling accident in Russia is low. For an accident on the Kola Peninsula, the population in Kirkenes, Norway would receive short-term doses below one year of natural radiation. However, *local-area* consequences can be severe. In 1985, a refuelling accident near Vladivostok killed ten people and contaminated an area six kilometres wide.

Harm to economic activity

Nuclear accidents and radioactive contamination can harm economic activity. This can happen directly, by damaging property, or indirectly, by damaging markets and consumer confidence.

Public anxiety over contamination, whether real or perceived, can have serious, long-lasting effects, especially where the acceptance of food products is concerned. For example, mad cow disease devastated the British beef industry, costing €820 million per year in lost exports from 1996 to 2000, while a dioxin scare in Belgium cost its food industry €1.5 billion in 2000. Clean seas are thus imperative to maintain consumer confidence in Norway's seafood exports, worth €3.4 billion in 2004.

Fact Box 2 – Scrapping nuclear-powered submarines

Status – As of autumn 2005:

In service	36
Withdrawn from service, fuel onboard	33
Withdrawn from service, fuel removed	23
Scrapped	60
Total	152

The remaining inactive submarines will probably be scrapped by 2010.

Dismantlement process and waste – Dismantling a submarine involves defueling the reactor, removing the reactor coolant, and disposing of radioactive components. The reactor compartment is cut from the hull and is stored separately as a single unit of radioactive waste.

On average, dismantling one submarine yields:

- 455 fuel assemblies
- 250 m^3 liquid radioactive waste
- One reactor compartment
- 125 m^3 of miscellaneous solid radioactive waste

Fuel – Reactor fuel may either be disposed of as high-level radioactive waste or reprocessed into new fuel. Russia normally reprocesses its fuel. Fuel unsuitable for reprocessing is disposed as waste.

Reactor compartment – The reactor sections are stored afloat at Saida Bay on the Kola Peninsula. They will be moved ashore once a storage facility is completed.

Threat to global security

Nuclear proliferation and terrorism pose global threats to security. The terrorist attacks against the USA in 2001 focused attention on the possibility that radioactive material could be diverted and used in terrorist actions.

Weapons-usable nuclear material in Russia is vulnerable to theft. There have already been several attempts to steal enriched uranium in the form of submarine fuel. This has led to efforts to improve the security of this material.

Radioactive waste is also vulnerable, as vast quantities are currently stored in the open with little security. Although waste cannot be used to manufacture a nuclear weapon, it can be used in a so-called "dirty bomb" to contaminate a limited area.

Early international cooperation

Following the Soviet Union's dissolution, Norway and other countries became increasingly concerned about the safety of Russian nuclear facilities and the consequences of the rapidly accumulating amount of nuclear material pending disposal. Because of Russia's apparent incapacity to deal with the situation safely and expeditiously, they have created several programmes to help.

Cooperative Threat Reduction programme (CTR)

CTR was created by the USA in 1991. Its chief focus is to eliminate strategic weapons systems, such as ballistic missile submarines (SSBNs), so that Russia can meet its arms reduction commitments. With an annual budget of about $450 million, CTR has been one of the most successful programmes in achieving demonstrable improvements in Russia. As of July 2006, CTR assisted Russia in dismantling 30 SSBNs. It hopes to dismantle a total of 39 by 2012.

Nuclear Safety Account

In 1993, the G-7 established the Nuclear Safety Account as a special grant facility within the European Bank to finance safety improvements at Soviet-designed nuclear power plants. Russia received €76 million for improvements at the Kola, Leningrad and Novovoronezh power plants. A strength of this programme is that it effectively concentrated donor funds on a few projects.

Material Protection, Control & Accounting (MPC&A)

The US created the MPC&A programme in 1994 to protect weapons-usable nuclear material. A companion to CTR, it has provided $4 billion in security improvements. As a result, thousands of warheads and hundreds of tons of nuclear material—including fresh submarine fuel—are more secure today. Protecting spent fuel, however, has been a low priority.

Norway's Action Plan for Nuclear Safety

Norway established its Action Plan in 1995 to protect health, the environment and economic activity. It has a broad focus with four priority areas, more than 100 projects, and a modest budget of about €125 million from 1995 to 2005. Its main accomplishments include improving infrastructure essential to managing radioactive waste and spent fuel. Other key objectives, such as emptying a spent fuel facility at Andreeva Bay on the Kola Peninsula, have not yet been realized.

Arctic Military Environmental Cooperation (AMEC)

AMEC was initiated by Norway in 1996 with Russia and the USA; the UK joined in 2003. Its main focus is the environmental aspects of submarine dismantlement. Despite a modest budget, it has made valuable contributions; including designing a container for storing spent fuel, and technologies to improve the disposal of solid radioactive waste. AMEC is currently considering methods for safely moving inactive submarines to dismantling facilities, in response to the *K-159* accident.

Increasing international engagement

The terrorist attacks against the USA in 2001 focused policy-makers on the potential for nuclear terrorism. Nuclear material in Russia was considered vulnerable to theft and diversion to those wanting to acquire a nuclear weapon or "dirty bomb." As the threat changed from a regional environmental issue to a global security issue, securing the material became a matter of urgency.

G-8 Global Partnership

Meeting in Kananaskis, Canada in June 2002, the G-8 adopted an ambitious initiative called the Global Partnership against the Spread of Weapons and Materials of Mass Destruction. They committed to raising $20 billion over ten years to support projects, particularly in Russia. Priorities include dismantling submarines and disposing of fissile materials.

Framework agreement for cooperation (MNEPR agreement)

Until 2002, international engagement was largely limited to the US and Norway, as other potential donors lacked cooperation agreements with Russia. These typically exempt assistance from taxes, indemnify donors of liability, outline audit controls, and address access to sites where assistance is used.

In 1999, Norway initiated negotiations for an agreement to facilitate broader participation (the MNEPR agreement, for Multilateral Nuclear Environmental Programme in Northwest Russia). Russia was unwilling to make concessions without guarantees of substantial contributions, which were not forthcoming, and negotiations deadlocked. Global Partnership pledges broke the deadlock, and the MNEPR agreement was signed in May 2003.

Northern Dimension Environmental Partnership (NDEP)

The NDEP was established in 2001 to harmonize donor assistance for environmental improvements in Russia. It pools contributions in a fund administered within the European Bank. An outgrowth of the EU's Northern Dimension initiative, the NDEP was later coupled to the Global Partnership. The NDEP has received **€**170 million for nuclear projects. The NDEP signed its first grant agreements with Russia in August 2005.

Challenges for cooperation

International engagement has grown significantly with Global Partnership funding and the MNEPR agreement. Nevertheless, several challenges remain.

Russian coordination and planning

The main challenge is for Russia to develop a viable, comprehensive strategy for coordinating domestic and international efforts. With many donors, it is now possible to address problems in northwest Russia, but assistance must be coordinated or critical gaps will remain.

The NDEP is helping Russia to develop a Strategic Master Plan. It is intended to be a comprehensive, harmonized work programme for dismantling submarines and service vessels, for managing spent fuel and waste, and finally for rehabilitating the environment.

Risk assessments

The sinking of the submarine *K-159* underscored the importance of assessing risks before undertak-

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ing clean-up activities—something Russia has given limited attention. The NDEP is assisting with a Strategic Environmental Assessment to ensure that the environmental, health, safety and social implications of its Strategic Master Plan are identified and assessed before its implementation. However, only a portion of international cooperation is channelled through the NDEP, thus it remains up to the Russian authorities and donors to conduct assessments for their activities.

Liability for nuclear damage

Donors have demanded that Russia assume liability for injuries that may arise from cooperation programmes, especially damage from a nuclear incident. This means Russia must pay for any damage, even if donor assistance contributed to causing it. Although Russia has reluctantly agreed and cooperation is moving forward, an independent legal analysis points out flaws in this arrangement.

First, Russia lacks the resources to pay for catastrophic damage, meaning either donors will pay, or victims will go uncompensated. Second, Russia's ratification of the Vienna Convention on Civil Liability for Nuclear Damage in March 2005 does not entirely improve the situation. The convention only requires a financial security of about €90 million. Furthermore, it does not apply to damage caused by incidents at military facilities.

Future of Russia's nuclear industry

The Russian nuclear industry has an ambition to grow at home and expand its services globally. Although its strategy to store and reprocess nuclear fuel from other countries has not yet come to pass, the issue is likely to come up again, given the likely growth in nuclear energy.

First, Russia is eager to sell reactors abroad and to couple power plant sales to long-term service and fuel-reprocessing contracts. They are seeking to expand their customer base to Asia, where nuclear power is still growing, such as China, India, South Korea and Taiwan, and to countries that plan to build nuclear power plants, such as Thailand, Vietnam and Iran.

Second, nuclear energy is being reconsidered in other countries, given the high demand for energy plus the need to reduce greenhouse gas emissions. Finland cited its Kyoto Protocol obligations as a primary reason for choosing to build a new nuclear power plant.

One of the chief obstacles to a renaissance in nuclear energy is waste management. For decades, the prevailing philosophy has been that states are responsible for disposing of their own radioactive waste. However, the threat of terrorism may make it more attractive to concentrate spent fuel and waste in a few well-guarded locations rather than in many poorly guarded ones. Mohamed El Baredei, head of the International Atomic Energy Agency, recently advocated regional waste repositories as a means of improving safety and security.

Russia is the only country that has expressed an interest in taking spent fuel from other states. Although the concept of regional waste repositories is still in the formative stage, Russia is the most likely place for locating one should the concept gain international support, especially from the USA. It is worth noting that although the US opposes Russia's desires to reprocess spent fuel from abroad, it does not categorically object to the idea of Russia storing it.

Nuclear transport

The prospect of large-scale spent fuel imports by Russia raises the potential for nuclear transport in Arctic waters. Russia has already designated 13 ports in the Arctic, Baltic and Far East for receiving radioactive material from abroad.

The port of Dudinka on the Yenisei River in Siberia is a likely candidate for receiving material from Western Europe and the Americas. Dudinka is already a major port on Russia's Northern Sea Route, with year-round shipping connections to Murmansk. For other European and Asian customers, Russian ports in the Baltic and Far East are more likely.

The Northern Sea Route is a viable route for Russian nuclear imports. Before it can be used, however, suitable vessels must be built. Ships must meet the International Maritime Organization's standards for transporting nuclear material and be strengthened for navigating ice-infested waters. No ships currently meet both requirements.

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Hegland trykkeri a.s

About FOCUS NORTH

This series of short fact sheets will cover current issues on developments in The High North. The first 10 issues are written by experts from Ocean Futures, www.ocean-futures.com The series can also be downloaded from the web, www.dnak.org

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